

CLAIMS:

We Claim:

1. A vehicle including an arrangement for controlling deployment of a side airbag from an airbag module to protect an occupant in a seat of the vehicle in a crash, the arrangement comprising

5 determining means for determining the position of at least a part of the occupant, and

a control circuit coupled to said determining means for controlling deployment of the side airbag based on the determined position of the at least a part of the occupant,

10 said determining means comprising at least one receiver arranged to receive electromagnetic waves from a space above a seat portion of the seat and a processor coupled to said at least one receiver for generating a signal representative of the position of the at least a part of the occupant based on the waves received by said at least one receiver.

2. The vehicle of claim 1, wherein said at least one receiver is mounted in a door of the vehicle.

15 3. The vehicle of claim 1, wherein said at least one receiver is mounted on or adjacent to the airbag module.

20 4. The vehicle of claim 1, wherein the vehicle has a side door, at least a portion of the arrangement residing on the side door of the vehicle.

25 5. A vehicle including an arrangement for controlling deployment of a side airbag from an airbag module to protect an occupant in a seat of a vehicle in a crash, the arrangement comprising

determining means for determining the position of at least a part of the occupant, and

a control circuit coupled to said determining means for controlling deployment of the side airbag based on the determined position of the at least a part of the occupant,

said determining means comprising

a transmitter arranged to transmit waves into a space above a seat portion of the seat, and

at least one receiver arranged to receive waves transmitted by said transmitter from the

30 space above the seat portion of the seat and a processor coupled to said at least one receiver for generating a signal representative of the position of the at least a part of the occupant based on the waves received by said at least one receiver.

6. The vehicle of claim 5, wherein said at least one receiver is mounted in a door of the vehicle.

5 7. The vehicle of claim 5, wherein said at least one receiver is mounted on or adjacent to the airbag module.

8. The vehicle of claim 5, wherein the vehicle has a side door, at least a portion of the arrangement residing on the side door of the vehicle.

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9. The vehicle of claim 5, wherein said at least one receiver is an ultrasonic transducer.

10. A vehicle including an arrangement for controlling deployment of a side airbag from an airbag module to protect an occupant in a seat of a vehicle in a crash, the arrangement comprising

15 determining means for determining the position of at least a part of the occupant, and

a control circuit coupled to said determining means for controlling deployment of the side airbag based on the determined position of the at least a part of the occupant.

20 said control circuit being arranged to control deployment of the side airbag by suppressing deployment of the side airbag, controlling a time at which deployment of the side airbag starts, controlling a rate of gas flow into the side airbag, controlling a rate of gas flow out of the side airbag or controlling a rate of deployment of the side airbag.

25 11. A vehicle including an arrangement for controlling deployment of a side airbag from an airbag module to protect an occupant in a seat of a vehicle in a crash, the arrangement comprising

determining means for determining whether an occupant is present in the seat, and

30 a control circuit coupled to said determining means for controlling deployment of the side airbag based on whether an occupant is present in the seat,

said determining means comprising at least one receiver arranged to receive electromagnetic waves from a space above a seat portion of the seat and a processor coupled to said at least one receiver for generating a signal representative of the presence or absence of an occupant in the seat based on the waves received by said at least one receiver.

12. The vehicle of claim 11, wherein said at least one receiver is mounted in a door of the vehicle.

13. The vehicle of claim 11, wherein said at least one receiver is mounted on or adjacent to the
5 airbag module.

14. The vehicle of claim 11, wherein said control circuit is structured and arranged to suppress deployment of the side airbag if an occupant is not present.

10 15. The vehicle of claim 11, wherein said determining means determine a position of at least a part of the occupant when an occupant is in the seat and said control circuit is structured and arranged to control deployment of the side airbag based on the determined position of at least a part of the occupant.

15 16. The vehicle of claim 11, wherein the vehicle has a side door, at least a portion of the arrangement residing on the side door of the vehicle.

17. A vehicle including an arrangement for controlling deployment of a side airbag from an airbag module to protect an occupant in a seat of a vehicle in a crash, the arrangement comprising

determining means for determining whether an occupant is present in the seat, and
20 a control circuit coupled to said determining means for controlling deployment of the side airbag based on whether an occupant is present in the seat,

said determining means comprising
a transmitter arranged to transmit waves into the space above the seat portion of the seat,
and

25 at least one receiver arranged to receive waves transmitted by said transmitter from a space above a seat portion of the seat and a processor coupled to said at least one receiver for generating a signal representative of the presence or absence of an occupant in the seat based on the waves received by said at least one receiver.

30 18. The vehicle of claim 17, wherein said transmitter transmits ultrasonic waves and said at least one receiver is an ultrasonic transducer.

19. The vehicle of claim 17, wherein said at least one receiver is mounted in a door of the vehicle.

20. The vehicle of claim 17, wherein said at least one receiver is mounted on or adjacent to the
5 airbag module.

21. The vehicle of claim 17, wherein said control circuit is structured and arranged to suppress deployment of the side airbag if an occupant is not present.

10 22. The vehicle of claim 17, wherein said determining means determine a position of at least a part of the occupant when an occupant is in the seat and said control circuit is structured and arranged to control deployment of the side airbag based on the determined position of at least a part of the occupant.

15 23. The vehicle of claim 17, wherein the vehicle has a side door, at least a portion of the arrangement residing on the side door of the vehicle.

24. A method for controlling deployment of a side airbag from an airbag module to protect an occupant in a seat of a vehicle in a crash, comprising the steps of:

20 determining the position of at least a part of the occupant by transmitting waves into a space above a seat portion of the seat, receiving waves from the space above the seat portion of the seat and generating a signal representative of the position of the at least a part of the occupant based on the received waves, and

25 controlling deployment of the side airbag based on the determined position of the at least a part of the occupant.

26. The method of claim 24, wherein the step of receiving waves comprises the step of arranging an ultrasonic transducer in the vehicle in a position to receive waves from the space above the seat portion of the seat.

30 26. The method of claim 24, wherein the step of receiving waves comprises the step of mounting a transducer capable of receiving waves in a door of the vehicle in a position to receive waves from the space above the seat portion of the seat.

27. The method of claim 24, wherein the step of receiving waves comprises the step of mounting a transducer capable of receiving waves in a door of the vehicle on or adjacent to the airbag module in a position to receive waves from the space above the seat portion of the seat.

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28. A method for controlling deployment of a side airbag from an airbag module to protect an occupant in a seat of a vehicle in a crash, comprising the steps of:

determining the position of at least a part of the occupant by receiving waves from a space above a seat portion of the seat and generating a signal representative of the position of the at least a part of the occupant based on the received waves, and

controlling deployment of the side airbag based on the determined position of the at least a part of the occupant,

the step of receiving waves comprising the step of arranging a receiver capable of receiving electromagnetic waves in the vehicle in a position to receive electromagnetic waves from the space above the seat portion of the seat.

29. The method of claim 28, wherein the step of receiving waves comprises the step of mounting a transducer capable of receiving waves in a door of the vehicle in a position to receive waves from the space above the seat portion of the seat.

30. The method of claim 28, wherein the step of receiving waves comprises the step of mounting a transducer capable of receiving waves in a door of the vehicle on or adjacent to the airbag module in a position to receive waves from the space above the seat portion of the seat.

31. A method for controlling deployment of a side airbag from an airbag module to protect an occupant in a seat of a vehicle in a crash, comprising the steps of:

determining the position of at least a part of the occupant, and

controlling deployment of the side airbag based on the determined position of the at least a part of the occupant,

30 the step of controlling deployment of the side airbag comprising at least one of the steps of suppressing deployment of the side airbag, controlling a time at which deployment of the side airbag

starts, controlling a rate of gas flow into the side airbag, controlling a rate of gas flow out of the side airbag and controlling a rate of deployment of the side airbag.

32. A method for controlling deployment of a side airbag from an airbag module to protect an

5 occupant in a seat of a vehicle in a crash, comprising the steps of:

determining whether an occupant is present in the seat by transmitting waves into a space above a seat portion of the seat, receiving waves from the space above the seat portion of the seat and generating a signal representative of the presence or absence of an occupant in the seat based on the received waves, and

10 controlling deployment of the side airbag based on the presence or absence of an occupant in the seat.

33. The method of claim 32, wherein the step of receiving waves comprises the step of arranging an ultrasonic transducer in the vehicle in a position to receive waves from the space above the seat portion of the seat.

34. The method of claim 32, wherein the step of receiving waves comprises the step of mounting a transducer capable of receiving waves in a door of the vehicle in a position to receive waves from the space above the seat portion of the seat.

35. The method of claim 32, wherein the step of receiving waves comprises the step of mounting a transducer capable of receiving waves in a door of the vehicle on or adjacent to the airbag module in a position to receive waves from the space above the seat portion of the seat.

25 36. The method of claim 32, further comprising the steps of:

determining a position of at least a part of the occupant when an occupant is in the seat, and

controlling deployment of the side airbag based on the determined position of at least a part of the occupant.

30 37. A method for controlling deployment of a side airbag from an airbag module to protect an occupant in a seat of a vehicle in a crash, comprising the steps of:

determining whether an occupant is present in the seat by receiving waves from a space above a seat portion of the seat and generating a signal representative of the presence or absence of an occupant in the seat based on the received waves, and

5 controlling deployment of the side airbag based on the presence or absence of an occupant in the seat,

the step of receiving waves comprising the step of arranging a receiver capable of receiving electromagnetic waves in the vehicle in a position to receive electromagnetic waves from the space above the seat portion of the seat.

10 38. The method of claim 37, wherein the step of receiving waves comprises the step of mounting a transducer capable of receiving waves in a door of the vehicle in a position to receive waves from the space above the seat portion of the seat.

15 39. The method of claim 37, wherein the step of receiving waves comprises the step of mounting a transducer capable of receiving waves in a door of the vehicle on or adjacent to the airbag module in a position to receive waves from the space above the seat portion of the seat.

20 40. The method of claim 37, further comprising the steps of:
determining a position of at least a part of the occupant when an occupant is in the seat, and
controlling deployment of the side airbag based on the determined position of at least a part of the occupant.

25 41. A method for controlling deployment of a side airbag from an airbag module to protect an occupant in a seat of a vehicle in a crash, comprising the steps of:

determining whether an occupant is present in the seat, and
controlling deployment of the side airbag based on the presence or absence of an occupant in the seat,

30 the step of controlling deployment of the side airbag comprising at least one of the steps of suppressing deployment of the side airbag, controlling a time at which deployment of the side airbag starts, controlling a rate of gas flow into the side airbag, controlling a rate of gas flow out of the side airbag and controlling a rate of deployment of the side airbag.